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Is There an Alternative Beyond Routine Blood Pressure Measurement?

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For decades there have been strong arguments for and against universal blood pressure screening in children. Already in 1982, Fixler and Laird[1] argued that the high proportion of false-positive results represents a significant cost to any blood pressure screening program. The American Academy of Pediatrics has also recognized in recent guidelines that even in data from NHANES (National Health and Nutrition Examination Survey), hypertension prevalence is typically derived from a single blood pressure measurement session,[2] more likely influenced by the white-coat effect. When repeated in a clinical setting the prevalence of confirmed hypertension is lower because of inherent blood pressure variability, as well as the accommodation effect (ie, the child relaxing once getting used to repeated measurements).[2] Although the American Academy of Pediatrics does recommend measuring blood pressure annually at routine well-child visits to enable early detection of hypertension from age 3 onwards, it does not recommend routine blood pressure screening in the school setting.[2] When performing cardiovascular risk assessment in children, the challenge thus remains to detect cardiovascular risk as early as possible, but also to do this effectively.

Indeed, elevated blood pressure in children should be a clinical priority as it tracks through childhood as shown in high-income country cohorts, such as the Young Finns (Finland) and Bogalusa Heart Study. In this issue of *Hypertension*, Naidoo et al[3] confirm these findings in an urban cohort from Soweto, South Africa. In this study they have shown in over 1 500 adults with a mean age of 23 years, that when evaluating multiple maternal, perinatal and early life risk factors, it was membership of the highest blood pressure trajectories from the age of 5 to 18 years that conferred the greatest risk for elevated blood pressure at the age of 23 years. More specifically membership of the highest systolic blood pressure category (a trajectory where blood pressure was elevated early and remained elevated), and the highest diastolic blood pressure category, resulted in a 4- and 5-fold risk, respectively, for having elevated blood pressure.

Despite early life blood pressure trajectories tracking toward adult hypertension, there seem to be consensus that universal blood pressure screening in schools may not be an effective approach to detect raised blood pressure early. Even routine blood pressures in clinical practice face the challenges of anxiety, white-coat effect, and intraindividual variability, yet are recommended[2] because of the fact that globally we are facing a hypertension (and obesity) epidemic and all possible tools should be used to head it off.

In the future, there is the potential for better approaches to detect cardiovascular risk in children. Aligned with recommendations in adult populations, out-of-office blood pressures, such as ambulatory blood pressure measurement in children will overcome the issues of anxiety and white-coat hypertension but would be an impractical approach for use in everyday screening. Home blood pressure monitoring in children, on the other hand, may be an ideal approach as it overcomes the white-coat effect and were shown to provide values comparable to ambulatory pressures in children.[4] Early detection of cardiovascular risk in children would be possible if home monitoring in families becomes the norm—although more home monitoring devices need validation in children.

In contrast to variables such as blood pressure—which reflects instantaneous risk but fluctuate considerably over time—aortic stiffness integrates and reflects the long-term effect of risk factors on the arterial wall, integrating the genetic predisposition of an individual.[5,6] Pulse wave velocity, as measure of arterial stiffness, correlates strongly with age and blood pressure, hence may simply provide a better measure of average blood pressure than a single reading in the clinic.[7] In adults, an individual participant meta-analysis reported aortic stiffness to predict future coronary and stroke events with a hazard ratio of 1.35 to 1.54, with a stronger relationship in younger adults.[8] These findings point to the potential of measuring arterial stiffness routinely in children, and similar to blood pressure—also with an easy noninvasive method. However, this is only a distant possibility as there remain several limitations that need to be addressed before arterial stiffness could become a routine measurement in clinical care. The evidence base for pulse wave velocity is limited in adults, when compared with studies with millions of blood pressure readings. Not even mentioning the small evidence base for pulse wave velocity studies in children. However, both in adults and children reference values have been published,[6,9] and confirmed also in children aged 6 to 18 years a steep increase in arterial stiffness with age. As the evidence base for

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pulse wave velocity measures increase, so should standardization of the procedural measurements in vascular research[10]—as encouraged by the American Heart Association. Hence, at this stage pulse wave velocity assessments are mainly a research tool, and more studies are required on the prognostic value of arterial stiffness, also in children.

With respect to cardiovascular risk in children from South Africa as highlighted by Naidoo et al,[3] it is worth mentioning that in a small highly controlled study in matched 6- to 8-year-old black and white boys from South Africa, arterial stiffness and diastolic blood pressure were significantly higher in black boys[11]—despite similar ages, weight, and height.

Notwithstanding these findings, the 2018 European Hypertension Guidelines[12] and the American Academy of Pediatrics[2] recommend against the measurement of arterial stiffness (pulse wave velocity) in asymptomatic adults or children in clinical practice.

In anticipation of robust evidence on the prognostic value of arterial stiffness assessments in children, all possible tools should be implemented to prevent early vascular aging in pediatric populations. As stated by the Lancet Commission on Hypertension,[13] approaches with population-wide impact are essential to reduce lifetime cardiovascular risk applicable to the entire population from conception. These include population-based approaches to prevent smoking,[6] increase physical activity, preventing obesity, and encouraging a healthy diet.

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